PATENT SPECIFICATION

Convention Date (United States): Aug. 4, 1924. **237,895**

Application Date (in United Kingdom): July 18, 1925. No. 18,361/25.

Complete Accepted: Nov. 26, 1925.

COMPLETE SPECIFICATION.

Improvements in Air Cleaners.

I, ARTHUR ALBERT BULL, a citizen of the United States of America, of 3021, Wabash Avenue, Detroit, Wayne County, Michigan, United States of America, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

This invention relates to an air cleaner and especially an air cleaner for separating the dust and grit from the air that is taken into the carburetter of an internal combustion engine. This cleaner effects the separation of the suspended matter in the air by inertia forces and centrifugal forces. The separated matter is then expelled from the cleaner by means of a small pressure built up by the inertia forces and by gravity. This will be more fully explained hereinafter.

Furthermore, provision is made for automatically adjusting the cross section of the air intake in accordance with the throttle opening so as to get sufficient velocity at all speeds to afford the forces that effect the separation and also so as to get sufficient air volume when the throttle is wide open or nearly wide open.

In the accompanying drawings:

Figure 1 is a side elevation of part of an internal combustion engine with my air cleaner installed thereon.

Figure 2 is a plan view of the cleaner.

Figure 3 is a vertical section taken on the line 3—3 of Fig. 2.

Figure 3^a is a section taken on the line 3^a—3^a of Fig. 3.

Figure 4 is a fragmentary elevation of the separator with the shell broken away to show the general construction.

Figure 5 is a detail of the spider that is supported in the shell.

Figure 6 is a graphic view showing how the vanes operate in securing air volume and air velocity adjustment.

[*Price* 1/-]

Figure 7 is a plan view of a modified form of the invention, in which a casting is utilized and there is no adjustment.

Figure 8 is a section on the line 8—8 of Fig. 6.

Figure 9 is a section on the line 9—9 of Fig. 6.

In the preferred form of my invention I use a sheet metal shell *a* which has a raised bottom *b*. This forms an incline in all directions from the centre of the bottom so as to tend to chute all the separate matter into the corner between the bottom of the shell and the upright walls, where it is expelled through ports *c*. A hood *d* is provided over this raised bottom, which tends to shield the collected matter from the swirl or vortex that takes place above the hood and which might permit some of the already precipitated particles being caught up again and drawn into the carburetter.

Near the top of the shell, the cylinder is shouldered as at *e* to form a rest for a spider *f*, as shown in detail in Fig. 5. The arms of this spider have turned over or channel portions *g* which form seats or stops for the lower ends of flexible spring vanes *h*. These vanes are convexo-concave members or segments which are welded as at *i* to a movable spider *j*. This spider is provided with a groove 10 in its periphery, which engages a rib 11 in the shell, thus guiding the vertically moving spider. The nut *k* is provided with a screw thread *m* pressed therein, which engages a screw thread *n* of a thimble *o* which is clamped in the split end of a cast elbow *q*. This nut is provided with a flange 12 which engages the top of the spider *j*. The nut *k* has an arm *p* which is connected with the carburetter throttle by means of the link *o*. Hence when the throttle opens wide the nut travels upwardly in a helical path, thereby allowing the spring vanes to force

Price 4s 6d

the spider *j* upwardly. This tends to straighten out the vanes and change the inclination of the same, thus increasing the cross sectional area of the air passage. When the nut is forced down it forces the spider down and flattens out the vanes and reduces the size of the air passage. As the vanes rise, the greater the inclination and the greater the cross section of the opening, which increases the volume of air drawn into the carburetter. It is well understood that the greater the volume of fluid drawn through a restricted orifice the greater the velocity at and immediately behind the orifice. Now it is desirable in order to get a uniformly efficient separating action, to have the velocity of the air substantially the same at all speeds of the engine, the separation depending upon forces which depend upon the velocity and the volume of the air. The vanes being curved and located as they are on the vertically travelling spider turn the incoming air and give it a tangential impingement upon the inner surface of the shell as it enters the shell. This causes the air to swirl around the inner shell, throwing out the suspended particles by centrifugal force at the outside of the air currents. Hence, they drop to the bottom of the shell both by gravity and by inertia forces for the pull of the engine suction is up through the thimble *n*, which therefore requires a sharp turning of the fluid and the heavier particles thereby tend to separate and drop to the bottom corners of the receptacle. I have found by actual tests that this swirling current of air which is drawn into the shell builds up a slight pressure at the bottom corner of the shell which will expel the collected dirt and separated matter at the bottom through the ports *c*, which are provided with small lips *x* to arrest and direct the precipitated matter out of the shell. This, therefore, affords a self-cleansing air cleaner, and no great amount of dirt can at any time collect to interfere with its action.

In the construction shown in Figs. 7 to 9 inclusive, the shell together with the vanes and the thimble are all cast integral. The same action takes place as regards the separation and giving the air and the suspended particles a swirling action or vortical movement but there is no adjustment of the vanes and consequently no regulation of the air and air velocity in accordance with the throttle opening.

Having now particularly described and ascertained the nature of my said invention and in what manner the same is to be performed, I declare that what I claim is:—

1. An air or gas cleaner comprising an outer shell having an open end and a substantially closed end, the open end being provided with a series of vanes adapted to impart to a gas passing therethrough an axial and outwardly directed swirling movement and with a suction conduit, the closed end being formed with restricted apertures adjacent its periphery and with an inwardly dished centre portion.

2. In an air or gas cleaner having means for producing a spiral movement of air or gas entering at one end, a suction conduit at the same end, and having its opposite end substantially closed and extending inwardly at the centre, the provision of a dust trap secured to the closed end near the centre to prevent suspended matter moving inwardly along the inwardly extending closed end.

3. An air cleaner as claimed in Claim 1 or 2 in which the bottom of the shell is concave in shape, substantially as described.

4. An air cleaner as claimed in Claim 2 in which the hood or dust trap is concave in shape, substantially as described.

5. An air cleaner as claimed in Claims 3 and 4 in which the radius of curvature of the hood or dust trap is greater than that of the bottom of the shell, substantially as described.

6. An air cleaner as claimed in Claims 1 or 2 in which a spider is supported near the top of the shell and carries a series of circularly arranged vanes substantially as described.

7. An air cleaner as claimed in Claim 6 in which the spider is supported between an elbow in the shell and a tube connected with the source of suction while the vanes are arranged around the tube and are attached to a second spider disposed above the first, substantially as described.

8. An air cleaner as claimed in Claim 1 in which means are provided for adjusting the cross section of the air passage into the cleaner having a connection with the throttle of a carburetter to adjust the cross section of such air passage in accordance with the throttle opening substantially as described.

9. An air cleaner as claimed in Claims 1 or 2 in which the means for giving the air a spiral or swirling movement in the shell comprises a series of flexible vanes, and means for flexing the vanes in such a way as to alter the inclination of the vanes for the purpose of regulating the cross section of the air passage in the top of the shell, substantially as described.

10. An air cleaner as claimed in Claim 6 in which the spider to which the vanes are attached is slidably supported by the shell and is adapted to be moved to change the angle of inclination of said vanes which are inclined to the longitudinal axis of the shell of the cleaner for the purpose of regulating the cross sectional area of the air passage substantially as described.

11. An air cleaner as claimed in Claim 7 in which the tube is provided with a thread on its outer surface and while a nut holding the spiders together engages with the thread in the tube whereby on the rotation of the nut around the tube the distance between the spiders is increased or decreased to change the angle of inclination of the vanes for the purpose of regulating the cross sectional area of the air passage, substantially as described.

12. An air cleaner as claimed in Claim 6 in which the spider is provided with channelled portions for receiving the free end of said spring vanes, substantially as described.

13. An air cleaner constructed and arranged to operate substantially as described and with reference to the accompanying drawings.

Dated this 17th day of July, 1925.

W. P. THOMPSON & Co.,
12, Church Street, Liverpool,
Chartered & Registered Patent Agents.

Redhill: Printed for His Majesty's Stationery Office, by Love & Malcomson, Ltd.—1925.

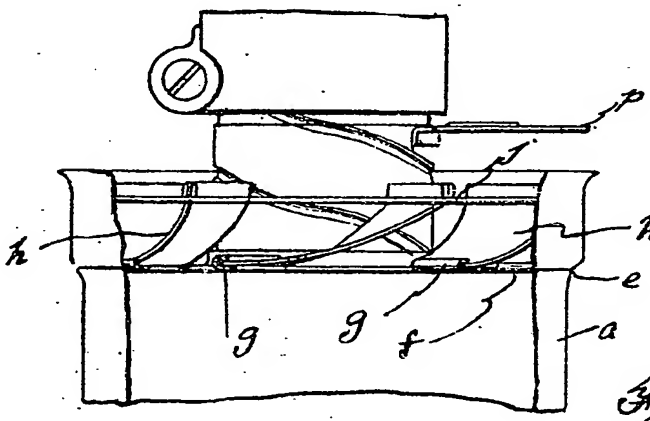

Fig. 4

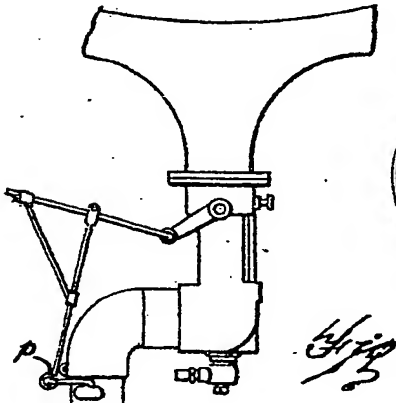

Fig. 1

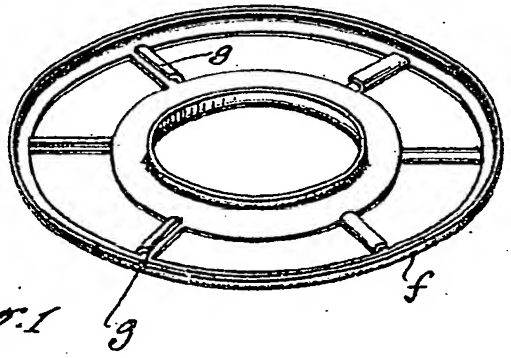

Fig. 5

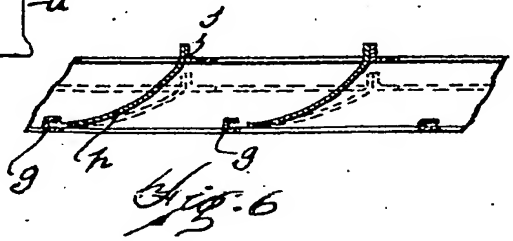

Fig. 6

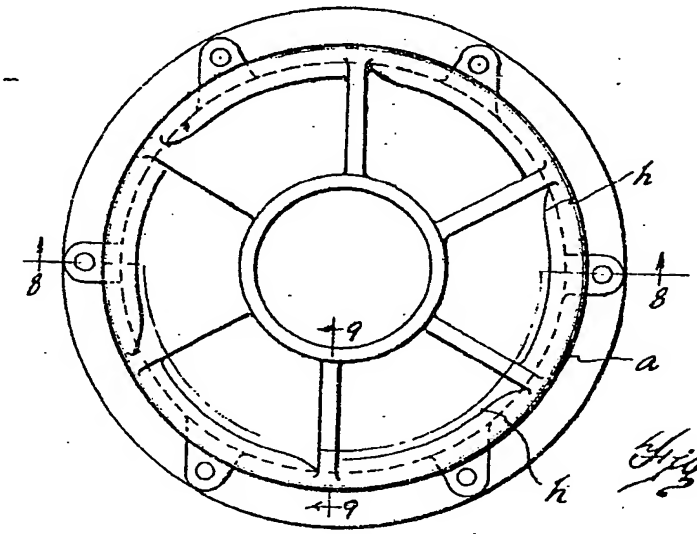

Fig. 7

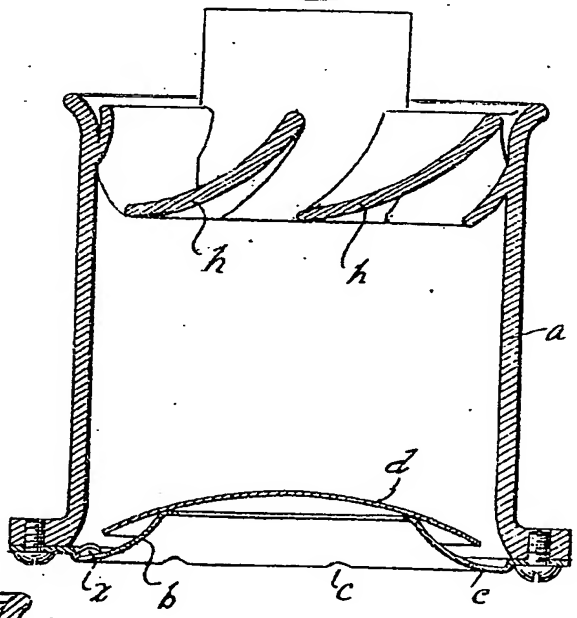

Fig. 8

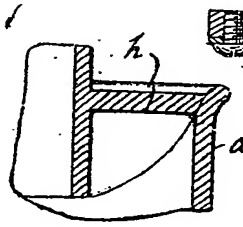

Fig. 9

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3 SHEETS
SHEET 1

SHEET 3

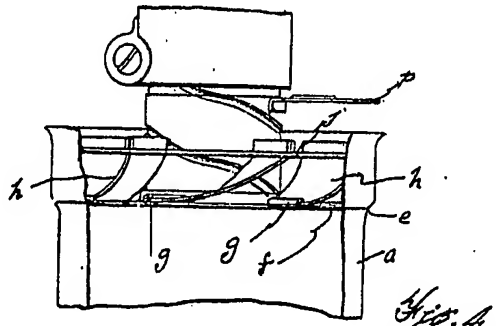

Fig. 4

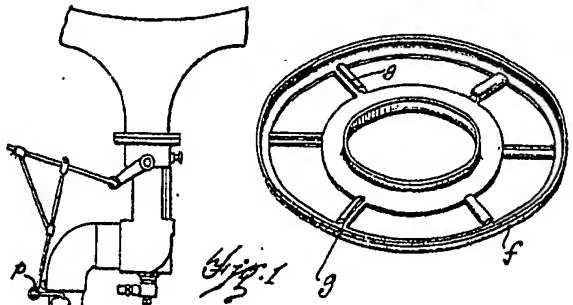

Fig. 1

Fig. 5

Fig. 6

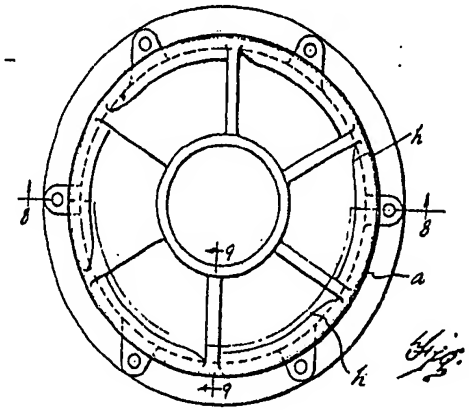

Fig. 7

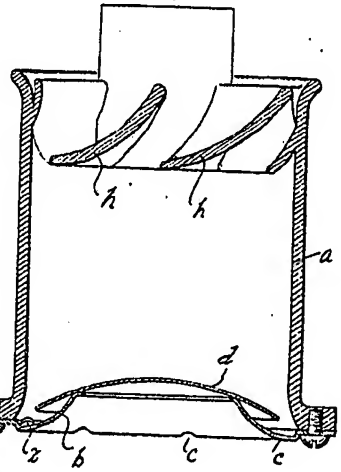

Fig. 8

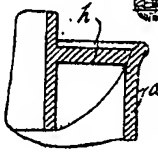

Fig. 9

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Fig. 2.

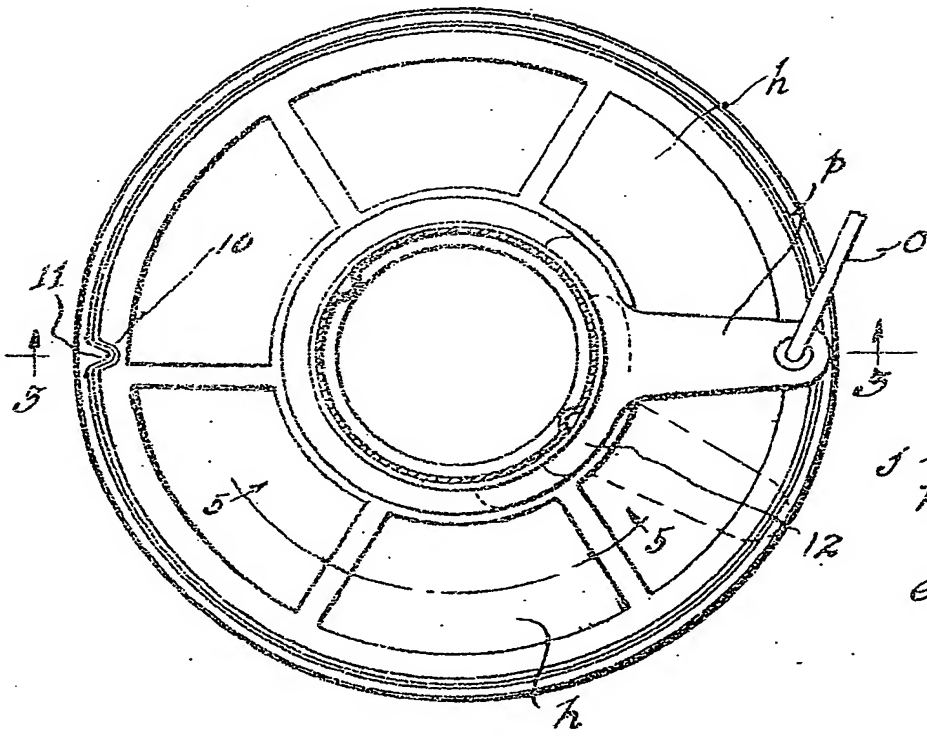


Fig. 3.

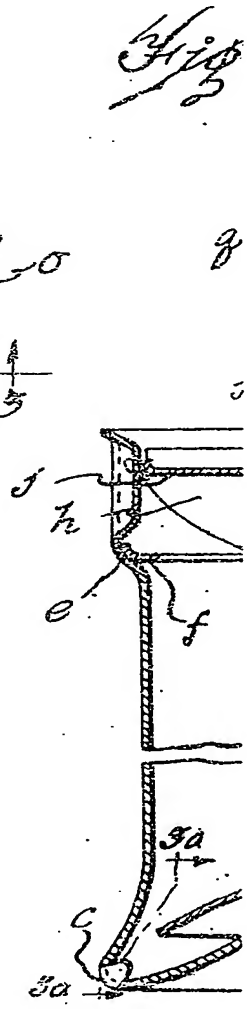


Fig. 3a.

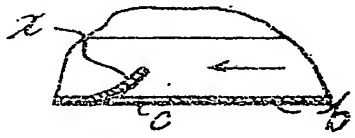
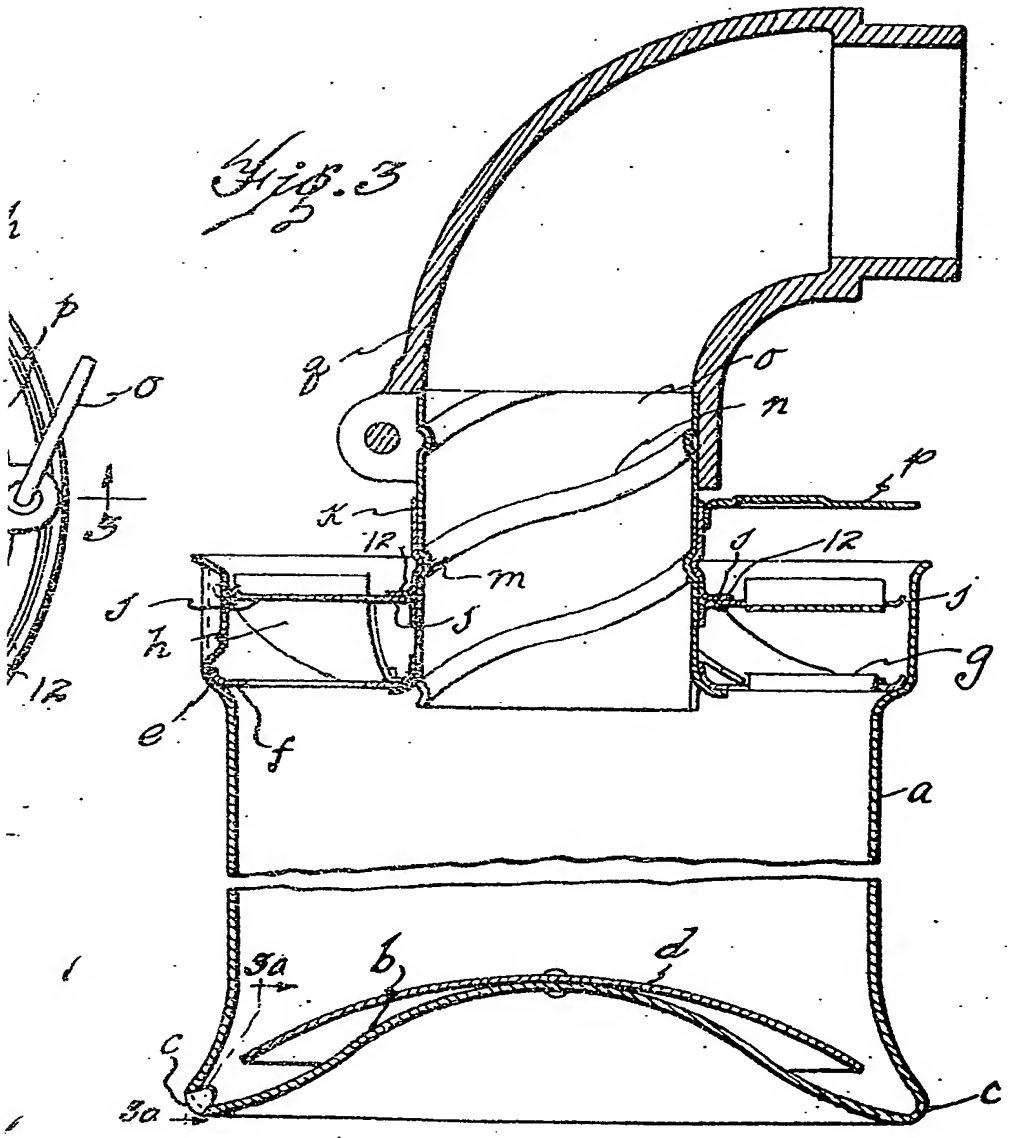


Fig. 3



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3 SHEETS
SHEET 2

[This Drawing is a full-size reproduction of the Original.]

Fig. 2.

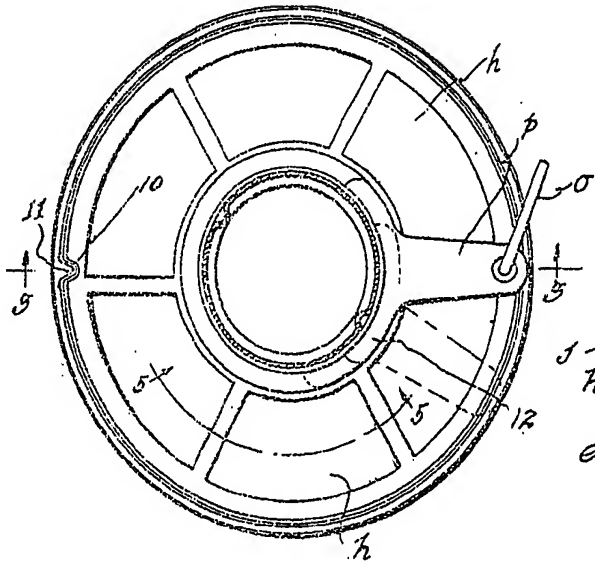

Fig. 3.

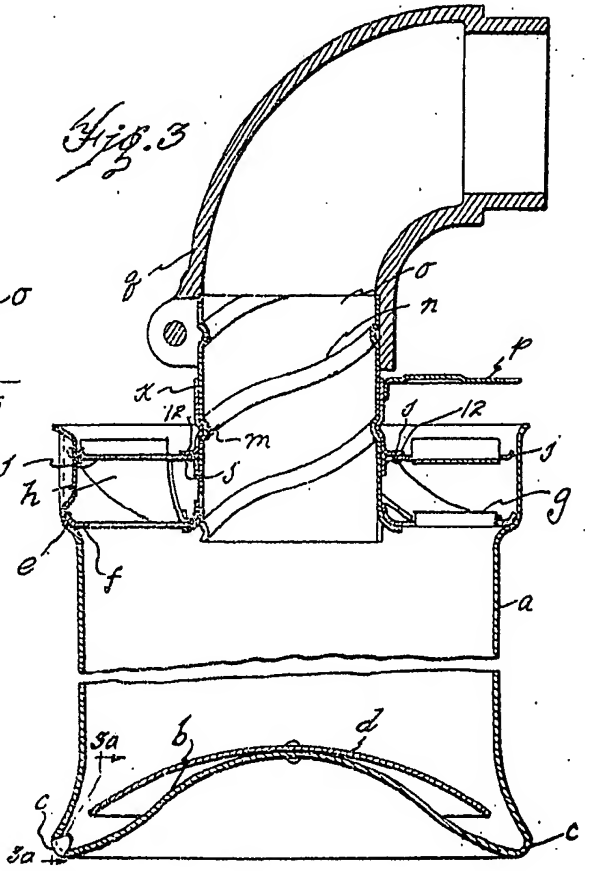

Fig. 3a.